



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> :

B65G 47/90

A1

(11) International Publication Number:

WO 98/09895

(43) International Publication Date:

12 March 1998 (12.03.98)

(21) International Application Number: PCT/IB97/01215

(22) International Filing Date: 5 September 1997 (05.09.97)

(30) Priority Data:

08/708,457

5 September 1996 (05.09.96)

US

(71) Applicant: WEA MANUFACTURING, INC. [US/US]; 1444 East Lackawanna Avenue, P.O. Box 321, Olyphant, PA 18447 (US).

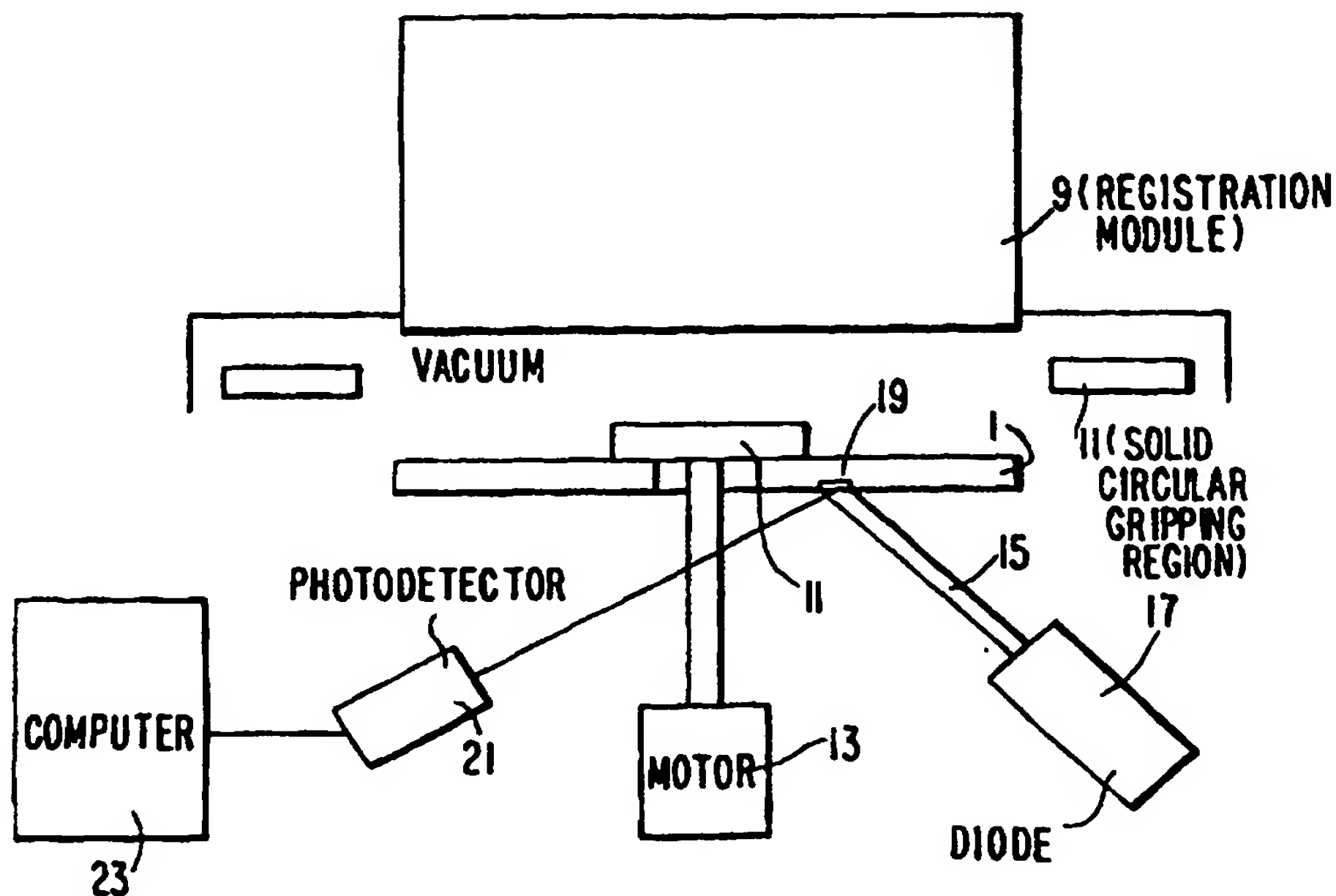
(72) Inventor: SUHAN, John, M.; 224 Second Street, Blakely, PA 18447 (US).

(74) Agent: RUBENSTEIN, Allen, I.; Gottlieb Rackman &amp; Reisman, P.C., 270 Madison Avenue, New York, NY 10016-0601 (US).

(81) Designated States: AU, JP, SG, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

**Published***With international search report.**Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*

(54) Title: PRINT-REGISTRATION INDEXING DEVICE



## (57) Abstract

An apparatus for removing an optical disc (2) from a printing conveyor (5), storing it off-line for an indefinite length of time, and returning it to the printing line at some reference angular orientation. A theoretically endless number of ink passes may be applied to an optical disc as a result of this device. Such a task may be achieved even with a printer possessing a small number of print heads.

BEST AVAILABLE COPY

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

## PRINT-REGISTRATION INDEXING DEVICE

### Field Of The Invention

This invention relates to the assembly line printing of information on compact discs during their manufacture in an on-line process. In particular it relates to printing registration to enable multiple color printing stages.

### Background Of The Invention

Compact discs are optical recording media that are read by a laser through one transparent surface of the disc. The optical data are pits that are too small to be seen by unaided eye, although they cause some diffraction that is visible. The data is recorded in a spiral from the inside outwardly, beginning a certain distance from a central hole in the disc. For identification purposes visible text is made to appear around the circumference of the central hole at a radius less than the start radius for the optical data.

Typically, compact discs have information printed on the surface that is not required to be transparent to a reading laser. The printing method usually employed is screen printing. Printing is usually accomplished by multiple print heads and/or multiple passes through the printing station of an assembly line.

- 2 -

### Brief Description Of The Invention

The Print-Registration Indexing Device provides the means for removing an optical disc from a printing line, placing it in a storage buffer, and then returning  
5 it to the printing line in the exact angular orientation that it originally possessed prior to its first removal from the printing line. Such steps may be repeated an endless number of times. Usage of such a device allows an optical disc printer to apply a theoretically endless  
10 number of ink passes to a disc, while using a printer with a small number of printing heads.

### Brief Description Of The Drawings

Figure 1 is a side cutaway view of the spindle and robot of the invention.

15 Figure 2 is a top view of the printer machine conveyer of the invention.

Figure 3 is side view of the present invention.

Figure 4 is top view of a disc having an identification band.

### 20 Detailed Description Of A Preferred Embodiment

The purpose of the Print Registration Indexing Device is to allow a printer with any number of print heads to apply an unlimited amount of ink patterns to an

- 3 -

optical disc, where the disc is removed from the printer's conveyor in between printer passes and returned to the printer with its previous angular orientation.

The registration task is achieved as follows.

5 Optical discs 1 stacked on spindles 3 are placed on the printer machine conveyor 5 by means of a robot arm 7. The angular orientation of these discs is truly random, in that the standard identification markings in the identification band of the disc reside at differing  
10 angles when comparing disc to disc. A few positions away from the entrance to the conveyor exists the registration module 9, a mechanical assembly which provides the actual registration of each disc. As discs pass under the registration module, a vacuum lifts the disc  
15 approximately one centimeter upward such that the disc becomes attached to a solid circular gripping region 11.

With the vacuum remaining intact, a steppe motor 13 soon activates to spin the optical disc at a constant velocity. during the spin, a beam of light 15  
20 originating from a laser diode 17 strikes the identification band 19 of the disc. The reflected light reaches a photodetector 21, whose electrical output is sent to a computer 23 for analysis.

At the computer, an algorithm analyzes the  
25 electrical output of the photodetector. Since the

- 4 -

identification band 19 of the optical disc is annular in shape, an endless circular array of data must be analyzed. The algorithm sets a reference point in the identification band where the stepper motor is given a  
5 signal to stop rotating. A minimum of two rotations is required so that the laser diode beam passes through the entire identification band with no breaks at the endpoints of the identification band. Each optical disc at the registration module will stop at the same  
10 reference point, affording an identical registration for each disc in the production run.

Once the stepper motor 13 stops at the reference position, the registration module places the disc back on the printer conveyor, where the vacuum 25 of  
15 the printer conveyor resumes its grip on the disc, holding it in place on the conveyor during printing until the exit robot 27 removes the disc from the line. This process can be run continuously for as many printer passes as the particular artwork requires.

20 While there have been shown and described and pointed out the fundamental novel features of the invention as applied to preferred embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the

device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention, which is expressed in the following claims.

I claim:

1. A method for removing an optical disc having an annular identification band from a printing line, and then returning it to the printing line in the angular orientation that it originally possessed prior to its first removal from the printing line comprising

(a) rotating said disc through at least two rotations under control of a stepping motor, wherein a predetermined location on the identification band is recognized,

(b) stopping the stepping motor, wherein the predetermined location on the identification band has said angular orientation, and

(c) returning said disc to the printing line with said identification band having said annular orientation.

2. The method for removing an optical disc from a printing line and then returning it to the printing line in the exact angular orientation that it originally possessed prior to its first removal from the printing line comprising

placing optical discs on a printer machine conveyor by means of a robot arm,

passing a disc a registration module, wherein a vacuum lifts the disc,

attaching the disc to a solid circular gripping region,

SUBSTITUTE SHEET (RULE 26)



7

activating a steppe motor to spin the  
optical disc at a constant velocity,

illuminating the identification band  
of the disc with a beam of light originating from a  
5 laser diode, wherein the reflected light reaches a  
photodetector,

setting a reference point in the  
identification band where the stepper motor is given  
a signal to stop rotating,

10 placing the disc back on the printer  
conveyor,

holding the disc in place on the con-  
veyor during printing, and removing the disc from  
the line.

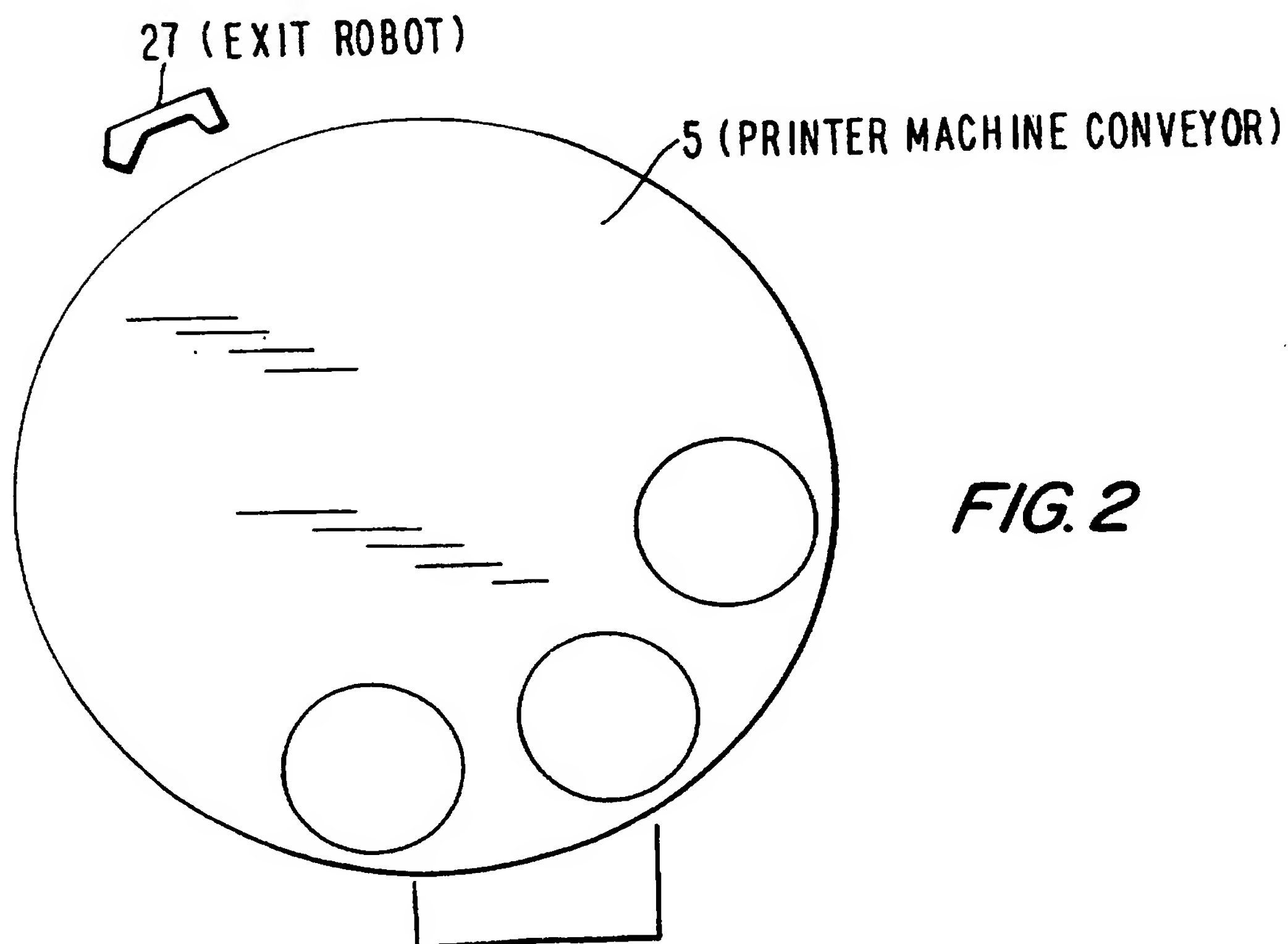
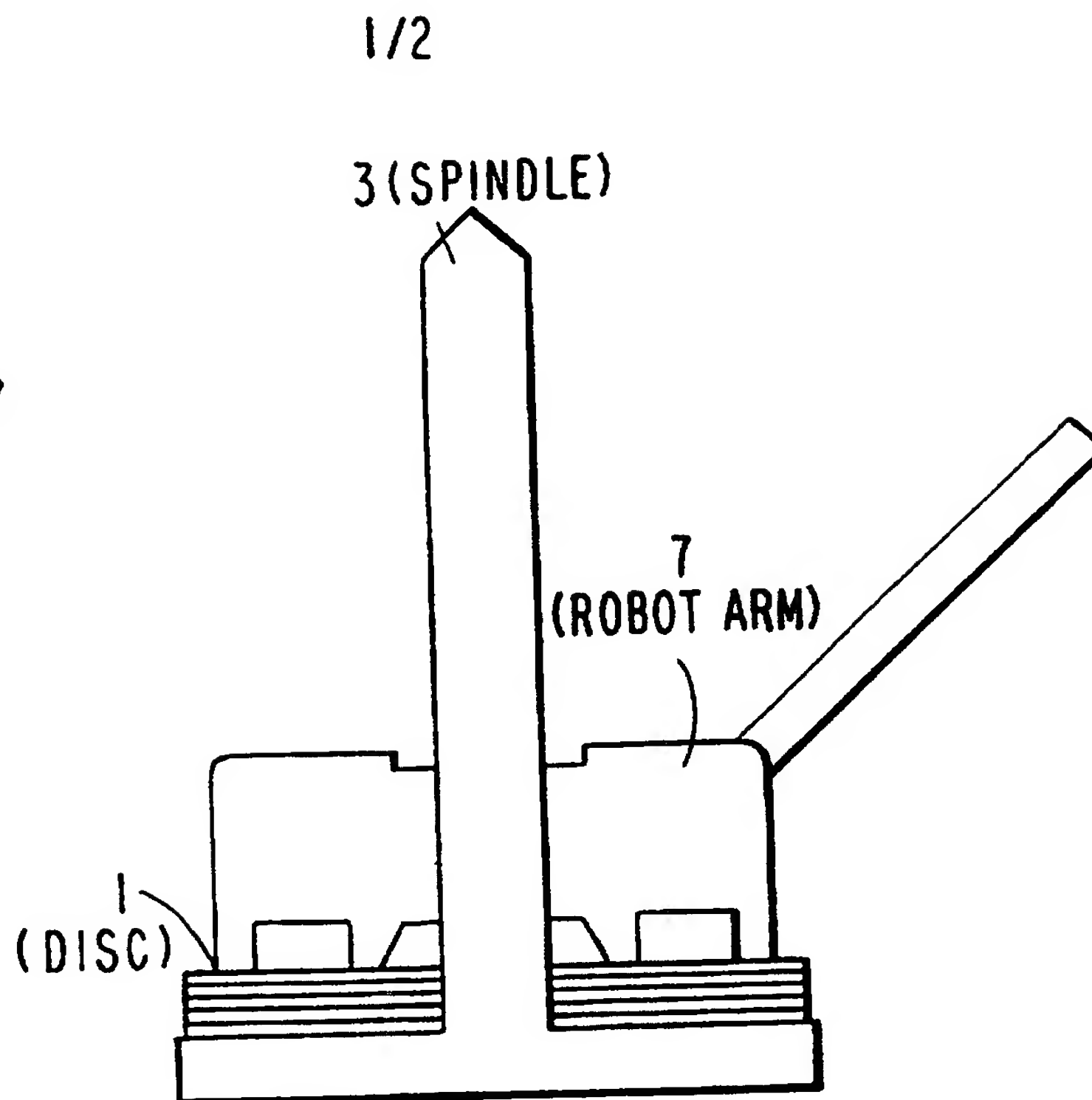
15

3. The method for removing an optical  
disc from a printing line and then returning it to  
the printing line of claim 2 wherein the disc is  
rotated through at least two rotations.

20

4. The method of claim 3 run continu-  
ously for as many printer passes as a particular  
artwork requires.

**FIG. 1**



**FIG. 2**

2/2

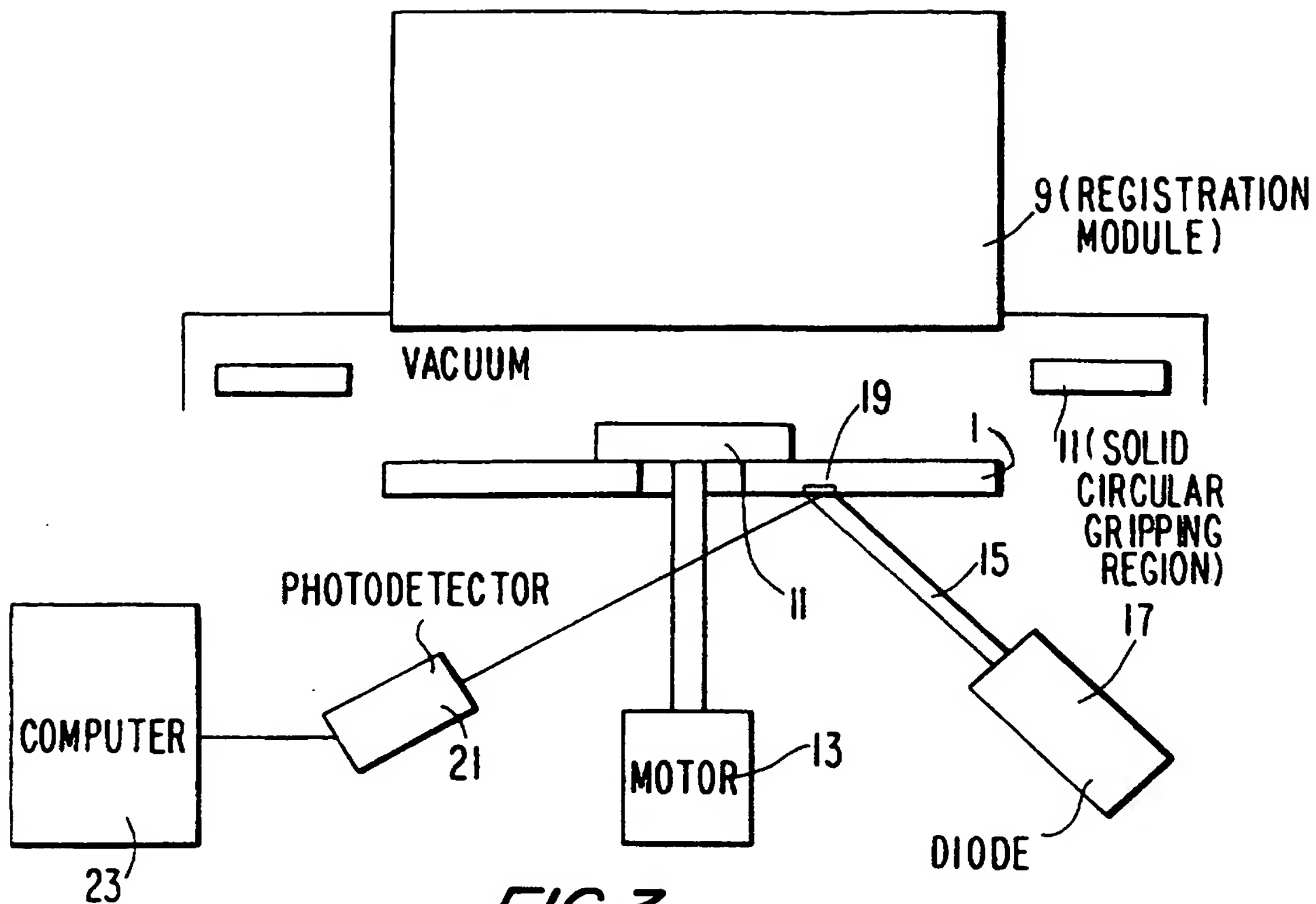
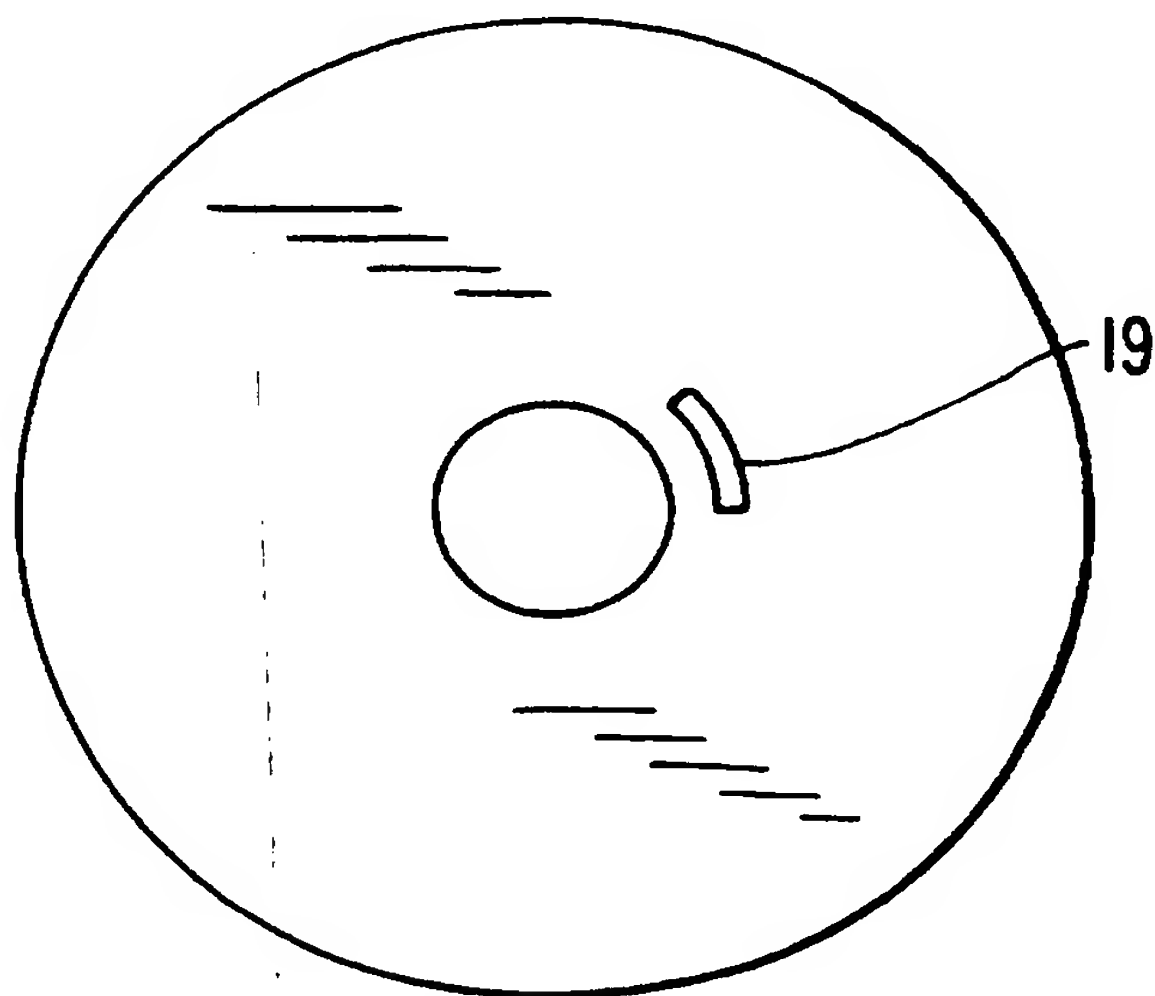


FIG. 3

FIG. 4



SUBSTITUTE SHEET (RULE 26)

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB97/01215

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B65G 47/90

US CL :101/485; 414/783

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 101/485, DIG. 30; 198/394; 414/783; 901/47

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,415,350 A (H.W. Murphy) 10 December 1968	NONE
A	US 4,954,044 A (I. Chizaki) 4 September 1990.	NONE
A	US 5,308,222 A (P. Bacchi et al.) 3 May 1994	NONE
A	US 5,429,045 A (W. Karlyn et al.) 4 July 1995	NONE
A	US 5,520,106 A (W. Karlyn et al.) 28 May 1996	NONE



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*B* earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*A* document member of the same patent family
*O* document referring to an oral disclosure, use, exhibition or other means	
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

31 DECEMBER 1997

Date of mailing of the international search report

27 JAN 1998

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231  
Facsimile No. (703) 305-3230

Authorized officer

Janice L. Krizek

Telephone No. (703) 308-2026

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**

**THIS PAGE BLANK (USPTO)**